CONTENTS OF VOLUME 33

NUMBER 1

Editorial	iii	
M. P. Fischer, D. Elsworth R. B. Alley and T. Engelder	1	Finite element analysis of the modified ring test for determining mode I fracture toughness
X. Zhang, D. J. Sanderson, R. M. Harkness and N. C. Last	17	Evaluation of the 2-D permeability tensor for fractured rock masses
N. Morita, A. D. Black and G.-F. Fuh	39	Borehole breakdown pressure with drilling fluids—I. Empirical results
N. Morita, G.-F. Fuh and A. D. Black	53	Borehole breakdown pressure with drilling fluids—II. Semi-analytical solution to predict borehole breakdown pressure
Technical Notes		
A. Bro	71	A weak rock triaxial cell
B. B. Thapa, T. C. Ke, R. E. Goodman, C. Tanimoto and K. Kishida	75	Numerically simulated direct shear testing of *in situ* joint roughness profiles
F. F. Gorbatsevich	83	Non-linearity of strain in hard crystalline rocks
E. Layer	93	Automatic roof bolt strain monitoring in coal mines
L. L. Mishnaevsky Jr	97	A new approach to the design of drilling tools
Ying Zou, W. E. G. Taylor and D. J. Heath	103	A numerical model for borehole breakouts
Geomechanics Abstracts	1A	

NUMBER 2

J.-J. Dong and Y.-W. Pan	111	A hierarchical model of rough rock joints based on micromechanics
J. Aler, J. Du Mouza and M. Arnould	125	Measurement of the fragmentation efficiency of rock mass blasting and its mining applications
M. Barbero, G. Barla and A. Zaninetti	141	Dynamic shear strength of rock joints subjected to impulse loading
A. I. Sofianos	153	Analysis and design of an underground hard rock voussoir beam roof
Technical Notes		
K. Shivakumar, M. V. M. S. Rao, C. Srinivasan and K. Kusunose	167	Multifractal analysis of the spatial distribution of area rockbursts at Kolar gold mines
Z. Şen	173	Theoretical RQD-porosity-conductivity-aperture charts
R. K. Goel, J. L. Jethwa and A. G. Paithankar	179	Correlation between Barton's Q and Bieniawski's RMR—a new approach

K. T. Chau and R. H. C. Wong — 183 Uniaxial compressive strength and point load strength of rocks

J. Aler, J. Du Mouza and M. Arnould — 189 Evaluation of blast fragmentation efficiency and its prediction by multivariate analysis procedures

Y. Wang — 197 The effect of a nonlinear Mohr–Coulomb criterion on the stresses and plastic deformation near a circular opening in a poorly consolidated permeable medium

A. Bro — 205 A low friction spherical seat for shear testing in a triaxial cell

E. M. Winkler — 215 Properties of marble as building veneer

Geomechanics Abstracts — 49A

NUMBER 3

U. H. Khan, H. S. Mitri and D. Jones — 219 Full scale testing of steel arch tunnel supports

M. Souley and F. Homand — 233 Stability of jointed rock masses evaluated by UDEC with an extended Saeb–Amadei constitutive law

R. Yang, W. F. Bawden and P. D. Katsabanis — 245 A new constitutive model for blast damage

P. H. S. W. Kulatilake, J. Chen, J. Teng, X. Shufang and G. Pan — 255 Discontinuity geometry characterization in a tunnel close to the proposed permanent shiplock area of the Three Gorges Dam site in China

M. J. Friedel, M. J. Jackson, E. M. Williams, M. S. Olson and E. Westman — 279 Tomographic imaging of coal pillar conditions: observations and implications

1992 Schlumberger Lecture Award Paper

B. Amadei — 293 Importance of anisotropy when estimating and measuring *in situ* stresses in rock

Geomechanics Abstracts — 103A

NUMBER 4

A. Serrano and C. Olalla — 327 Allowable bearing capacity of rock foundations using a non-linear failure criterium

A. J. Campos de Orellana — 347 Pressure solution creep and non-associated plasticity in the mechanical behavior of potash mine openings

D. D. Kana, D. J. Fox and S. M. Hsiung — 371 Interlock/friction model for dynamic shear response in natural jointed rock

J. Song and K. Kim — 387 Micromechanical modeling of the dynamic fracture process during rock blasting

E. Hakami and E. Larsson — 395 Aperture measurements and flow experiments on a single natural fracture

Technical Notes
C. P. Nathanail 405 Kinematic analysis of active/passive wedge failure using stereographic projection

J. Poutet, D. Manzoni, F. Hage-Chehade, C. G. Jacquin, M. J. Boutéca, J.-F. Thovert and P. M. Adler 409 The effective mechanical properties of reconstructed porous media

J.-F. Couvreur and J.-F. Thimus 417 The properties of coupling agents in improving ultrasonic transmission

C. Dai, H. Mühlhaus, J. Meek and M. Duncan Fama 425 Modelling of blocky rock masses using the Cosserat method

R. W. Zimmerman and G. S. Bodvarsson 433 Effective transmissivity of two-dimensional fracture networks

Discussion
J. R. Carr 439 Discussion of a paper by A. Den Outer *et al.* "Difficulties with using continuous fractal theory for discontinuity surfaces"

Authors' Reply
A. Den Outer, J. F. Kaashoek and H. R. G. K. Hack 441 Authors' Reply to Discussion by J. R. Carr regarding the paper "Difficulties with using continuous fractal theory for discontinuity surfaces"

Geomechanics Abstracts 149A

NUMBER 5

P. P. Oreste and D. Peila 443 Radial passive rockbolting in tunnelling design with a new convergence-confinement model

B. Benmokrane, Haixue Xu and E. Bellavance 455 Bond strength of cement grouted glass fibre reinforced plastic (GFRP) anchor bolts

T. Watanabe and K. Sassa 467 Seismic attenuation tomography and its application to rock mass evaluation

R. H. C. Wong, K. T. Chau and P. Wang 479 Microcracking and grain size effect in Yuen Long marbles

B. C. Haimson, M. Y. Lee, N. Feknous and P. De Courval 487 Stress measurements at the site of the SM3 hydroelectric scheme near Sept Iles, Quebec

T. W. Hicks, R. J. Pine, J. Willis-Richards, S. Xu, A. J. Jupe and N. E. V. Rodrigues 499 A hydro-thermo-mechanical numerical model for HDR geothermal reservoir evaluation

E. Alonso, I. Carol, C. Delahaye, A. Gens and P. Prat 513 Evaluation of safety factors in discontinuous rock

Technical Notes
P. Baud, T. Reuschlé and P. Charlez 539 An improved wing crack model for the deformation and failure of rock in compression

D. J. Reddish and E. Yasar 543 A new portable rock strength index test based on specific energy of drilling

Geomechanics Abstracts 193A

NUMBER 6

S. Okubo and K. Fukui 549 Complete stress–strain curves for various rock types in uniaxial tension

R. Yoshinaka, M. Osada and T. V. Tran 557 Deformation behaviour of soft rocks during consolidated-undrained cyclic triaxial testing

J. F. Labuz, S.-T. Dai and E. Papamichos 573 Plane-strain compression of rock-like materials

B. J. Pestman and J. G. Van Munster 585 An acoustic emission study of damage development and stress–memory effects in sandstone

D. P. Adhikary, A. V. Dyskin and R. J. Jewell 595 Numerical modelling of the flexural deformation of foliated rock slopes

R. K. Bhasin, N. Barton, E. Grimstad P. Chryssanthakis and F. P. Shende 607 Comparison of predicted and measured performance of a large cavern in the Himalayas

A. Roff, W. S. Phillips and D. W. Brown 627 Joint structures determined by clustering micro-earthquakes using waveform amplitude ratios

Technical Notes

L. Yang, K. Zhang and Y. Wang 641 Back analysis of initial rock stresses and time-dependent parameters

Xia-Ting Feng, Yong-Jia Wang and Jian-Guo Yao 647 A neural network model for real-time roof pressure prediction in coal mines

B. B. Thapa and R. E. Goodman 655 The induced wedge test for field measurement of joint friction

Geomechanics Abstracts 241A

NUMBER 7

E. Sellers and F. Scheele 659 Prediction of anisotropic damage in experiments simulating mining in Witwatersrand quartzite blocks

C. T. Lin, B. Amadei, J. Jung and J. Dwyer 671 Extensions of discontinuous deformation analysis for jointed rock masses

J. Rutqvist and O. Stephansson 695 A cyclic hydraulic jacking test to determine the *in situ* stress normal to a fracture

S. C. Maxwell and R. P. Young 713 Seismic imaging of rock mass responses to excavation

1994 Schlumberger Lecture Award Paper

A. M. Linkov 727 Rockbursts and the instability of rock masses

International Society for Rock Mechanics. Commission on Testing Methods **J. L. Yow, Jr (Co-ordinator)** 733 Suggested method for deformability determination using a stiff dilatometer

Technical Notes

V. Rudajev, J. Vilhelm, J. Kozák and T. Lokajíček 743 Statistical precursors of instability of loaded rock samples based on acoustic emission

R. K. Goel, J. L. Jethwa and B. Dhar 749 Effect of tunnel size on support pressure

Geomechanics Abstracts 291A

NUMBER 8

R. Singh, T. N. Singh and B. B. Dhar 757 Coal pillar loading in shallow mining conditions

M. Maksimović 769 The shear strength components of a rough rock joint

1995 Schlumberger Lecture Award Paper

L. J. Pyrak-Nolte 787 The seismic response of fractures and the interrelations among fracture properties

International Society for Rock Mechanics Commission on Rock Grouting
R. Widmann (Co-ordinator) 803

Geomechanics Abstracts 337A

Volume 33 Index I